Harlequin Duck Surveys in the Central Eastern Slopes of Alberta: Spring 1998.

Paul Gregoire, Jeff Kneteman and Jim Allen.

Prairie and Northern Region 1999
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Jeff Kneteman[1]
Jim Allen[2]

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[1]Alberta Fish and Wildlife, Hinton District Office.
[2]Alberta Fish and Wildlife, Rocky Mountain House Regional Office.

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ABSTRACT

In response to a general lack of knowledge on the abundance and distribution of the Harlequin Duck within Alberta, the Canadian Wildlife Service in cooperation with Alberta Environment undertook surveys of the eastern slopes of Alberta. Helicopters provided an effective and efficient means to survey for Harlequin Ducks. High concentrations of Harlequin Ducks were observed on the McLeod, Sulphur and Berland Rivers, with smaller concentrations on the Muskeg and Wapiabi watercourses. Few to no Harlequin Ducks were observed on many streams located south of the Brazeau River. Harlequin concentrations on the McLeod, Berland and Wapiabi streams were not within protected areas. Harlequin Ducks appear to be uncommon and demonstrate a patchy and clumped distribution along their range within the eastern slopes of Alberta.

RÉSUMÉ

Devant le manque général de données sur les effectifs et la distribution de l'Arlequin plongeur en Alberta, le Service canadien de la faune a effectué des relevés de l'espèce sur le versant est des Rocheuses dans cette province, en collaboration avec le ministère de l'Environnement de l'Alberta. Le recours à des hélicoptères s'est révélé un moyen efficace et efficient de réaliser les relevés. On a observé de fortes concentrations d'Arlequins plongeurs sur les rivières McLeod, Sulphur et Berland et de plus petites concentrations sur les rivières Muskeg et Wapiabi. En revanche, sur de nombreux cours d'eau situés au sud de la rivière Brazeau, tout au plus quelques individus ont été observés. Les concentrations relevées sur les rivières McLeod, Berland et Wapiabi n'étaient pas dans des zones protégées. Il ressort de ces relevés que l'Arlequin plongeur n'est pas une espèce commune et que sa distribution est morcelée et se distingue par la présence de grappes par endroits dans son aire sur le versant est des Rocheuses en Alberta.

ACKNOWLEDGEMENTS

We thank Beth MacCallum of Bighorn Environmental Design Ltd. and her team for their cooperation with the ground truthing portion of the study. We also thank the Environment Canada Environmental Assessment Research and Development Fund Committee for providing the funding necessary for this timely survey.

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INTRODUCTION

The Harlequin Duck (*Histrionicus histrionicus)* is unique amongst waterfowl for its preference to breed along turbulent rivers and streams often associated with mountainous habitats. On the breeding grounds, the Harlequin Duck's preference for remote and difficult terrain does not readily lend itself to being studied and consequently little is known about the distribution and abundance of the Harlequin Duck in western North America. In Alberta, the Harlequin Duck breeds along the eastern slopes of the Rocky Mountains which is an area of increasing human activity and where the distribution and population size of the species is poorly understood.

Habitat loss and disturbance from logging, mining, grazing and recreational activities are potential threats to the well being of this species. The Harlequin's relationships to habitat variables are poorly understood other than at a descriptive level, therefore responses to human activity may be difficult to identify and assess in a timely fashion with the current knowledge base. The lack of reliable inventory information hinders understanding of population status and effective management. The species is believed to be characterized by patchy distribution, low densities, restricted use of habitats, low productivity and to be long-lived, all features associated with sensitive species. The Harlequin Duck has been identified as a species of concern in Washington, Montana, Wyoming, British Columbia and Alberta. The purpose of this survey was to provide needed data on the distribution and abundance of the Harlequin Duck in Alberta, to assist managers in the conservation of Harlequin Ducks and their habitat.

OBJECTIVES

1. Identify an effective and efficient method to survey Harlequin Ducks in remote mountainous habitats.

2. Increase the proportion of the breeding range of the Harlequin Duck that has been surveyed in Alberta (necessary for formulating a population estimate for Alberta)

3. Identify Harlequin Duck concentrations and breeding streams.

METHODS

Surveys were flown along the eastern slopes of the Rocky Mountains of Alberta in an area between the communities of Grande Cache and Nordegg (Figure 1). Because Harlequin Ducks have specific habitat requirements, local area wildlife biologists were contacted to help determine which streams were more likely to contain ducks. Due to timing and financial constraints, specific blocks or subsets

within a particular geographic area were surveyed. Surveys were timed such that the ducks had returned from the wintering grounds and were clustered on spring staging/breeding streams in the initial phases of nesting activities. This timing was critical, as Harlequin's tend to move gradually upstream and become less visible as nesting activities progress (MacCallum and Bugera 1998).

Surveys were flown in a Bell 206B helicopter. An observer/navigator was positioned in the front seat and an observer/recorder was positioned in the rear seat on the same side as the pilot. To minimize ferrying (deadheading) time, streams were flown alternately in upstream and downstream directions. Streams were flown primarily at a height just above treetops (estimated at 30m) and at an average speed of 30 knots (55 kph). The helicopter followed the stream course and flew directly over the stream or slightly to one side. Streams were followed until either the stream approached the headwaters, was deemed too small, was not visible by overhanging vegetation or a deep canyon was encountered. Global Positioning System (GPS) co-ordinates were recorded for all sightings and for survey start and end points. The time of day of each observation was also recorded and whether the birds were paired, single females or single males.

Weather conditions were considered very good overall, with predominantly overcast skies and very good visibility.

Two crews of biologists were used to undertake the surveys. The first crew flew the route between the Smoky and Brazeau Rivers and the second crew flew the block between the Brazeau and North Saskatchewan Rivers. The block of streams between the Smoky and Athabasca Rivers was flown May 26, 1998, the block between the Athabasca and Brazeau Rivers was flown May 27 and the block between the Brazeau and North Saskatchewan Rivers was flown May 28 and 29, 1998.

It was deemed necessary to compare the visibility from the helicopter with that of ground based surveys. Therefore aerial surveys of the McLeod River system were timed to overlap that of an intensive ground survey of this system undertaken by Bighorn Environmental Design Ltd. on May 27 and 28, 1998. The ground survey entailed having observers walk in or along the shorelines of all streams in the upper McLeod River system recording all birds observed. This river system was flown on May 27, 1998.

RESULTS

Distribution and Abundance

Relatively high concentrations of Harlequin Ducks were observed along the Sulphur, Berland and Muskeg Rivers located within the Smoky/Athabasca block (Figure 2). Within this block, a total of 109 birds (48 pairs) were observed on 235 kilometers of stream. The majority of these birds were observed within the confines of the Provincially designated Willmore Wilderness Park. Birds were observed on all 4 streams surveyed. (The starred checkpoints on the figures delineate the start and end points for the surveys on each watercourse.)

Within the Athabasca/Brazeau block, only the McLeod River had a high concentration of birds (42 birds, or 18 pair) (Figure 3). The Cardinal River had a relatively low occurrence, for river size, with observations of 10 ducks on 54 kilometers of surveyed stream.

In the Brazeau/North Saskatchewan River block, Harlequin Ducks were found in moderate numbers only on the Blackstone-Wapiabi drainage (Figures 4&5). A total of 37 ducks were observed on 362 kilometers of stream including stretches of 9 separate streams. No birds were observed on 4 streams and 1, 2 and 3 birds were observed, respectively, on the 3 remaining streams.

Overall, only 5 of the 15 watercourses surveyed had in excess of 20 ducks, with the remainder having between zero and ten ducks observed.

Densities

The Smoky/Athabasca block provided an observed average density of 0.464 ducks per kilometer of surveyed stream whereas the Brazeau/North Saskatchewan block had only 0.102 ducks per kilometer surveyed (Table 1). The river measurements reported on Table 1 include the surveyed tributaries.

The McLeod River was particularly interesting as we observed 21 birds in a 5 kilometer stretch of river, or approximately 4.2 birds per kilometer, the highest density of birds observed during the surveys (Estimated distance between the Town of Cadomin to near the confluence with Luscar Creek).

Sex Ratios

With a sample size of 198 ducks we were able to identify a total of 95 females and 103 males or an overall ratio of 48 percent female to 52 percent male (Table 1). The Smoky/Athabasca block was 47 percent female and 53 percent male (n=109); the Athabasca/Brazeau block was 44 percent female and 56 percent male (n=52); while the Brazeau/North Saskatchewan block was 57 percent female and 43 percent male (n=37).

Visibility Correction

We calculated a visibility correction by comparing ground survey results on the McLeod River system with aerial counts. We observed 19 females and 23 males from the air, while Bighorn Environmental (pers. comm.) observed 23 females and 30 males for an overall visibility of 79.25 percent for the McLeod River system. Bighorn Environmental undertook their ground surveys over a two day period. On May 27 (the day we flew our survey) Bighorn Environmental surveyed Whitehorse Creek and the McLeod River downstream from Whitehorse Creek, and observed 19 females and 26 males to our 17 females and 21 males over the same area, which converted to an 84.5 percent visibility. On May 28 Bighorn Environmental surveyed the remaining smaller reaches of the McLeod River upstream of Whitehorse Creek and observed 4 males and 4 females to our 2 males and 2 females over the same area, which translated to a 50 percent visibility. The overall 79.25 percent visibility for the McLeod River system was then used to estimate visibility for all of the streams we surveyed (Table 2).

Population Estimates

We also compared the number of birds observed on the aerial survey with the mark-resighting population estimate for the McLeod River, undertaken by Bighorn Environmental. We observed 42 adults on the McLeod River system compared to the mark-resighting study's estimated population of 78 birds (MacCallum *et al* 1999). Therefore our aerial visibility was 53.85 percent of the population estimate. With only one opportunity for comparative surveys, relationships of observed birds to population estimates are preliminary. However, our population estimate for those streams surveyed in the Smoky/Athabasca block is 202 ducks, 97 ducks for the surveyed streams in the Athabasca/Brazeau block and only 69 ducks for the areas surveyed in the Brazeau/North Saskatchewan block (Table 2). The estimated population of ducks per kilometer of stream is also shown on Table 2.

DISCUSSION

Helicopters provided an effective and efficient means to survey for Harlequin Ducks. Preliminary results reinforce suggestions that Harlequin Ducks have very specific habitat requirements, are not numerous and have a patchy distribution in the Province of Alberta. These results support descriptors associated with describing the Harlequin Duck as a sensitive species.

Harlequin Ducks responded to the presence of an approaching helicopter in a unique fashion. As a helicopter approached, the ducks typically moved off the bank or shoreline into the middle of the stream and remained there, either watching the helicopter while swimming or diving as the helicopter approached. Only one Harlequin Duck flushed during the entire survey and it alighted nearby upstream. This flushing was attributed to the helicopter flying too close to the water at the time the bird was encountered (e.g. 15 meters). The Harlequin Duck's observed behaviour of moving to open water was credited with improving visibility from the helicopter and may represent how the Harlequin Duck naturally responds to avian predators. Other duck species, such as the Mallard and Green-winged Teal, readily took to the air well in advance of the helicopter.

The Willmore Wilderness Park (Smoky/Athabasca River block) provided good habitat for Harlequin Ducks, with high concentrations observed on the Sulphur, Berland and Muskeg Rivers. Most birds observed on the Muskeg River were located outside the protective boundaries of the Willmore Wilderness Park. As a general rule, in these streams, we observed fast flowing waters with pool and riffle characteristics as well as good vegetation cover along the shoreline and banks.

The McLeod River (Athabasca/Brazeau block) also had high densities of Harlequin Ducks and stream characteristics similar to that of the Smoky/Athabasca block. Only the Cardinal River had few birds and it was characterized by an abundance of riffles, a large amount of outwash gravel and lacked the pools and shoreline vegetation. Adjacent beaver ponds were searched but no birds were found.

The Bighorn Wildland Recreation Area west of Nordegg contained few birds (Brazeau/North Saskatchewan block). Many of these rivers contained glacial water and no Harlequin Ducks were observed in them, possibly a result of reduced water clarity or a smaller food supply as suggested by the colder waters. The Blackstone-Wapiabi drainage appeared to be the only stream system with more than incidental numbers of Harlequin Ducks.

The density of birds observed per kilometer of stream was not unlike that reported in other studies. However, the density of birds per kilometer was a function of where the surveys commenced on the downstream portion of the streams. This limitation is readily apparent when comparing densities of birds on the two most productive streams, the Sulphur River and the McLeod River. The lower portion of

the Sulphur River was not formally surveyed because it was very muddy, and not deemed as suitable Harlequin Duck habitat. Similarly, although few ducks were expected in the lower reaches of the McLeod River, due to stream characteristics, it was nevertheless surveyed to ensure that that was indeed the case. A more appropriate comparison (and better representation of Harlequin Duck habitat) may be a comparison of the distance between where the first downstream duck was observed and the headwaters where the survey ended. If this is done, then the Suphur and McLeod Rivers, respectively, have similar densities of 0.393 and 0.325 females per kilometer. Considering only the area between where the first and last duck was observed on a stream, may also yield similar results.

An ongoing Harlequin Duck research and monitoring program on the McLeod River, undertaken by Bighorn Environmental, provided an opportunity to compare a subset of our aerial counts to that of ground based inventories. We noted minor limitations, such as, Bighorn Environmental conducted their ground counts over a two day period and it was therefore possible they may have counted some of the birds twice (although the population was well marked). We also found that aerial visibility was reduced in the uppermost reaches of the McLeod River due to overhanging vegetation and trees. However, despite these limitations, because the great majority (85 percent) of birds were observed in the lower sections of the McLeod River, and because we observed that stream conditions on these portions were similar to those encountered in other surveyed areas, we accepted the overall 79.25 percent air/ground visibility as a reasonable approximation of visibility from the air. Also, because there was mark-resighting data available for the McLeod River, we used this information to estimate Harlequin Duck populations for the watersheds we surveyed, using our 53.85 percent of population visibility estimation. With only one year of comparative data, caution should be exercised when interpreting the population results.

How do our observations compare to other known concentrations of Harlequin Ducks in Alberta? Smith (1999a) using mark-resighting data estimated a population of 157 adult Harlequin Ducks on the Bow River in Banff National Park, the largest known in the Province of Alberta. Other known concentrations include the Maligne River in Jasper National Park (Hunt 1996), where 31 adults were banded in one year and they estimated the population exceeded 60 individuals. Smith (1999b) estimated a population of 41 and 23 adult Harlequin Ducks, respectively, on the Kananaskis and Elbow Rivers using mark-resighting data. Our observations to date place the McLeod, Sulphur and Berland Rivers as having concentrations that are among the largest known in the Province. The Muskeg River and Wapiabi Creek also had notable concentrations. The McLeod, Muskeg and Wapiabi watercourses are not protected and would merit consideration by resource managers.

We intend to continue to survey the eastern slopes to inventory important Harlequin Duck habitats, thereby providing decision makers with the information necessary to better manage the Harlequin Duck resource within Alberta. We also plan to continue to refine the aerial versus ground visibility comparisons.

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Table 1: Observed numbers and densities of Harlequin Ducks.

Stream	Km Flown	Prs	Fem	Male	Total Ducks	Pairs Per Km	Ducks Per Km
Between Smoky and Athabasca River							
Little Berland River	25.9	4	1		9	0.154	0.347
Berland River	76.05	16		4	36	0.21	0.473
Muskeg River	74.37	11		1	23	0.148	0.309
Sulphur River	58.63	17	2	5	41	0.29	0.699
SUB TOTAL	*234.95*	*48*	*3*	*10*	*109*		
SUB MEAN						*0.204*	*0.464*
Between Athabasca and Brazeau River							
McLeod River	86.95	18	1	5	42	0.207	0.483
Cardinal River	53.99	4		2	10	0.074	0.185
SUB TOTAL	*140.94*	*22*	*1*	*7*	*52*		
SUB MEAN						*0.156*	*0.369*
TOTAL	***375.89***	***70***	***4***	***17***	***161***		
MEAN						***0.186***	***0.428***
Between Brazeau and North Saskatchewan River							
Blackstone River	54.31	3	1	1	8	0.055	0.147
Wapiabi Creek	37.60	10	3		23	0.266	0.612
Brown Creek	27.35	1			2	0.037	0.073
Chungo Creek	27.76				0	0	0
Bighorn River	37.80				0	0	0
Job Creek	20.64				0	0	0
Brazeau River	31.67	1	1		3	0.032	0.095
Cline River	88.94		1		1	0	0.011
North Saskatchewan River	36.06				0	0	0
TOTAL	***362.13***	***15***	***6***	***1***	***37***		
MEAN						***0.041***	***0.102***
GRAND TOTAL	***738.02***	***85***	***10***	***18***	***198***		
GRAND MEAN						***0.115***	***0.268***

Table 2: Estimated numbers of Harlequin Ducks.

Stream	Visibility Correction[1]		Estimated Population[2]	
	# Ducks	Ducks per km of stream	# Ducks	Ducks per km of stream
Between Smoky and Athabasca River				
Little Berland River	11.4	0.438	16.7	0.643
Berland River	45.4	0.597	66.7	0.876
Muskeg River	29.0	0.390	42.6	0.572
Sulphur River	56.8	0.882	76	1.294
TOTAL	*137.5*		*202*	
MEAN		*0.585*		*0.86*
Between Athabasca and Brazeau River				
McLeod River	53.0	0.609	77.8	0.894
Cardinal River	12.6	0.233	18.5	0.342
TOTAL	*65.5*		*96*	
MEAN		*0.466*		*0.68*
Between Brazeau and North Saskatchewan River				
Blackstone River	10.1	0.185	14.8	0.272
Wapiabi Creek	29.0	0.772	42.6	1.133
Brown Creek	2.5	0.092	3.7	0.135
Chungo Creek	0	0	0	0
Bighorn River	0	0	0	0
Job Creek	0	0	0	0
Brazeau River	3.8	0.120	5.6	0.176
Cline River	1.3	0.014	1.9	0.020
North Saskatchewan River	0	0	0	0
TOTAL	*46.7*		*69*	
MEAN		*0.129*		*0.19*
GRAND TOTAL	*249.8*		*367*	
GRAND MEAN		*0.338*		*0.50*

[1] Estimated number of ducks using the 79.25 percent air/ground visibility correction.

[2] Estimated number of ducks using the 53.85 percent population estimate visibility correction.

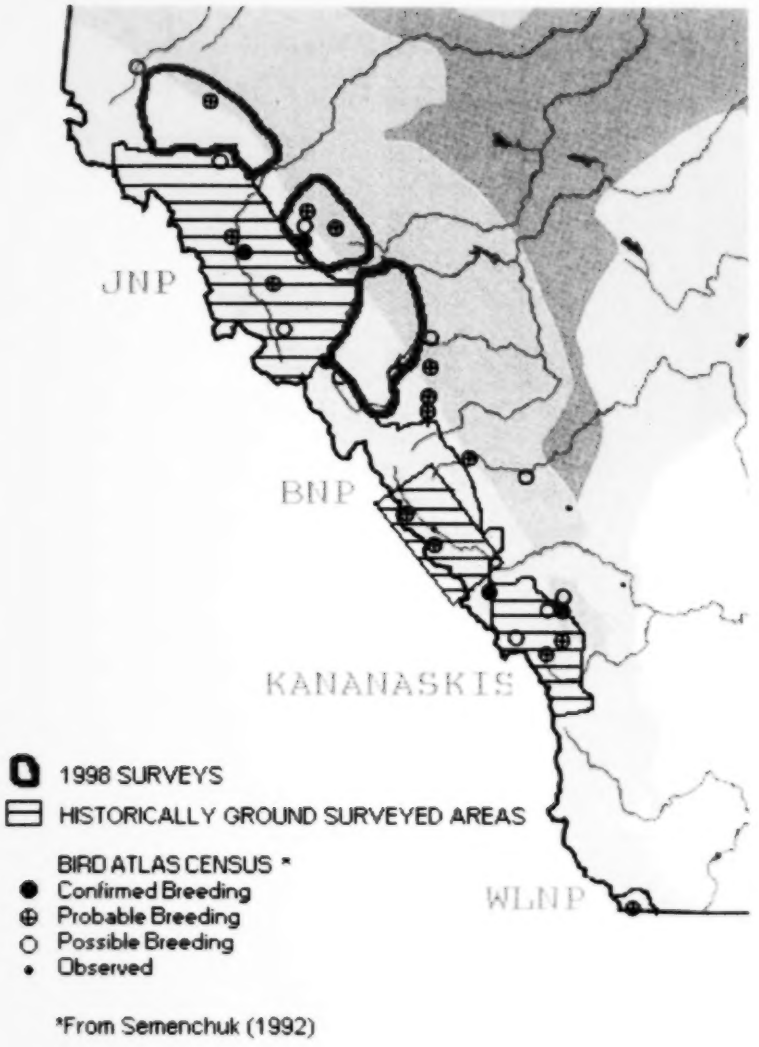
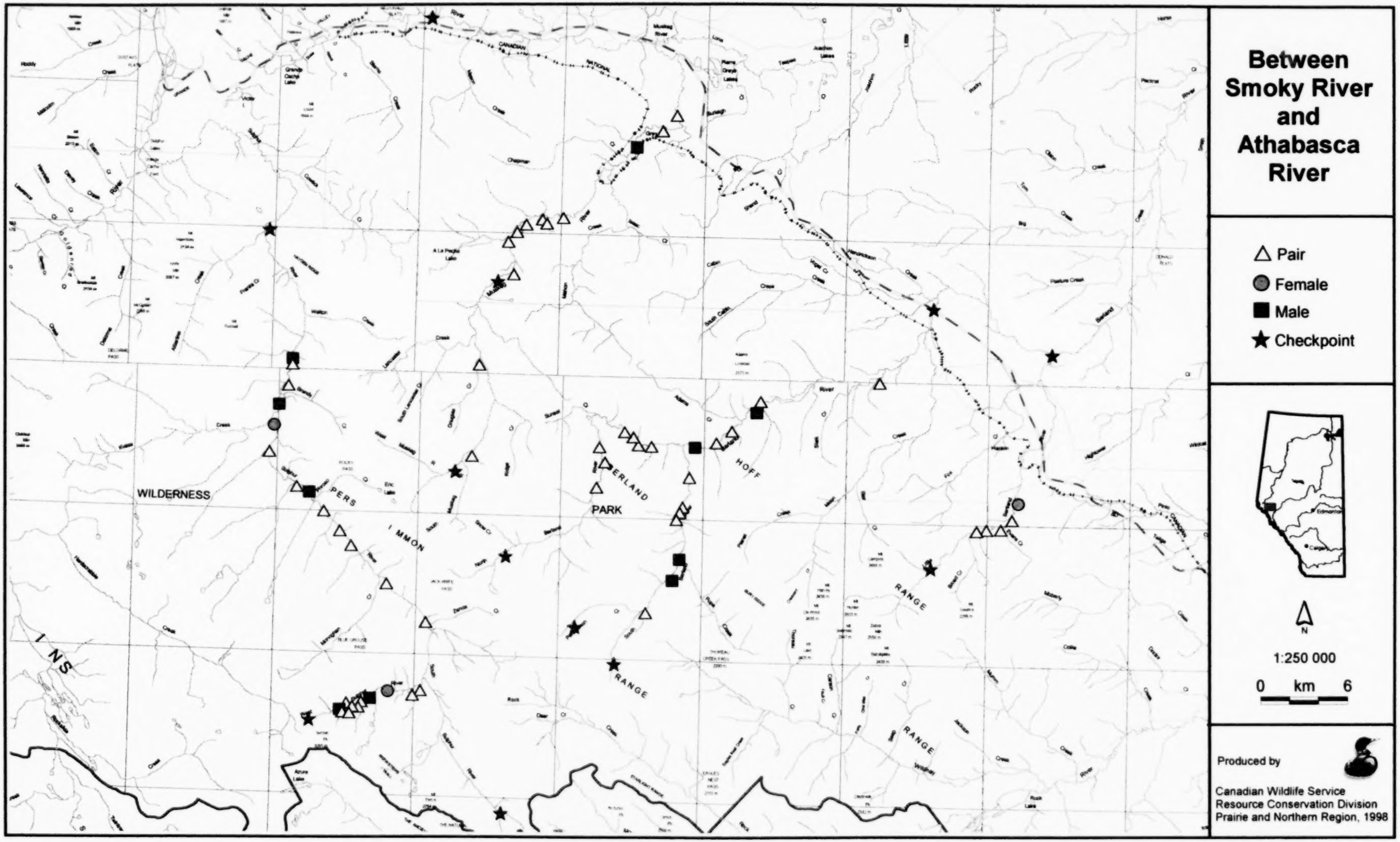


Figure 1: Areas surveyed in 1998.


Between Smoky River and Athabasca River
Pair
Female
Male
Checkpoint
WILDERNESS
PERS
IMMON
ERLAND
PARK
HOFF
RANGE
RANGE
RANGE
INS
1:250 000
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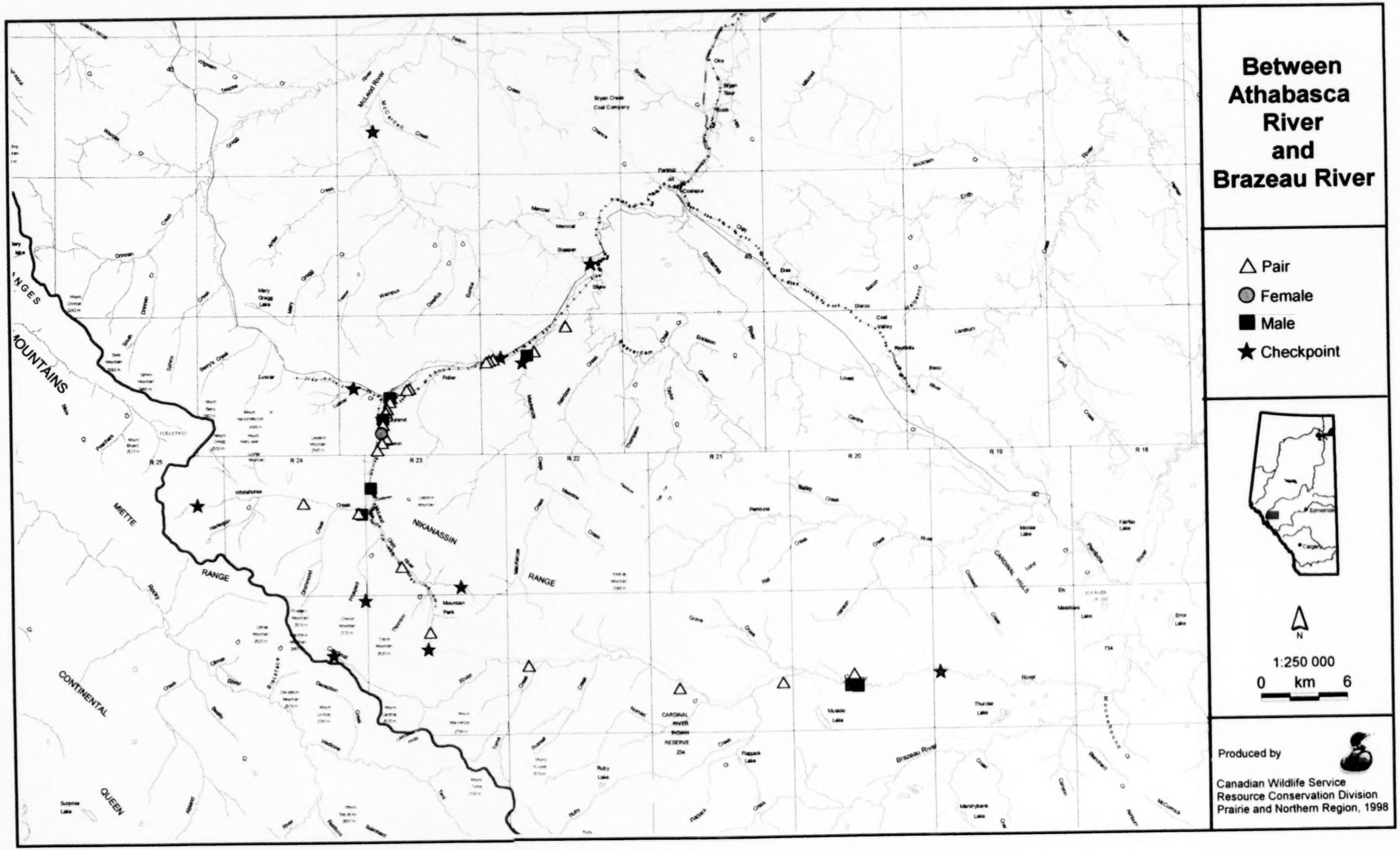
Produced by
Canadian Wildlife Service
Resource Conservation Division
Prairie and Northern Region, 1998

Figure 2


Between Athabasca River and Brazeau River
Pair
Female
Male
Checkpoint
N
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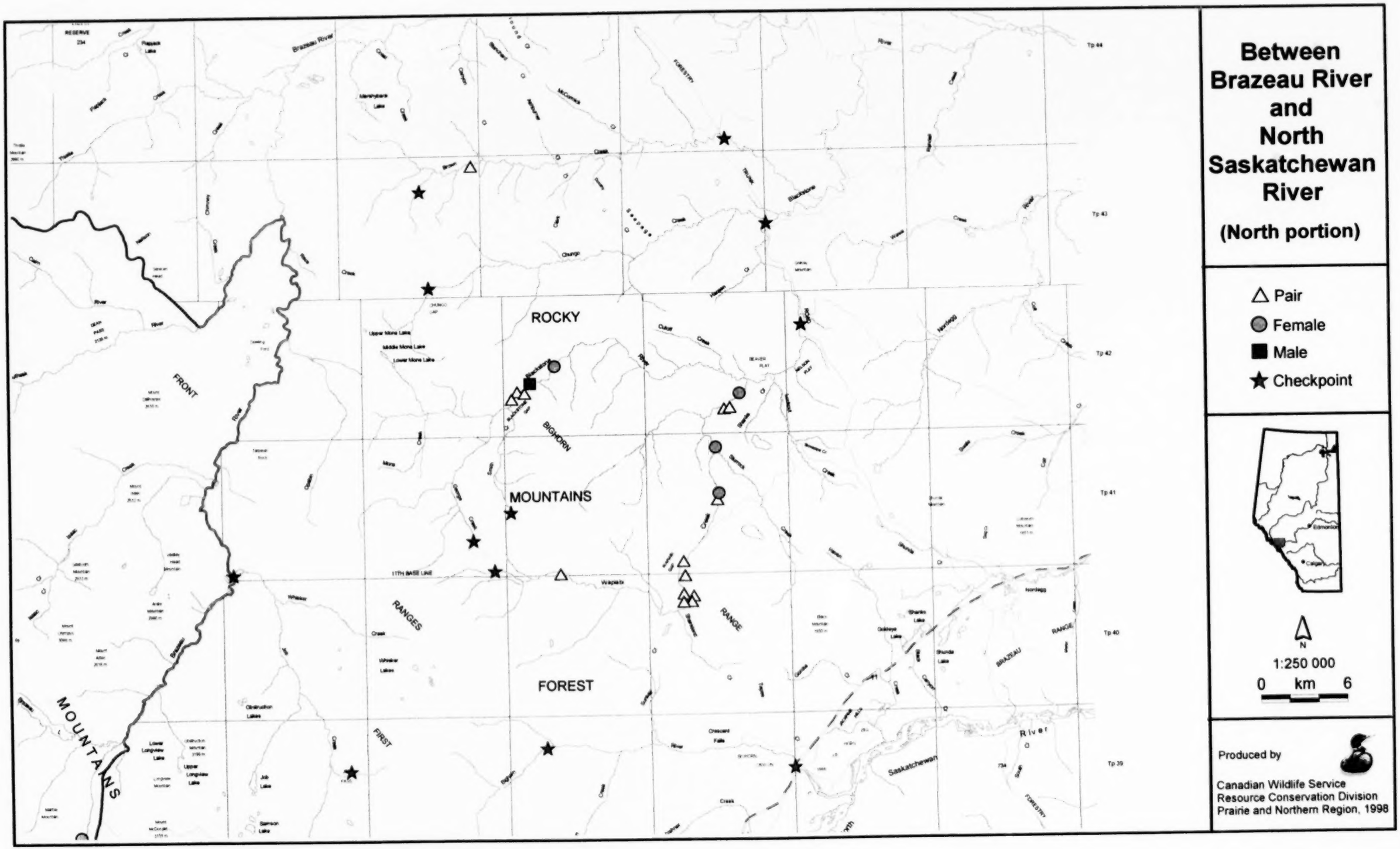
Produced by
Canadian Wildlife Service
Resource Conservation Division
Prairie and Northern Region, 1998
MOUNTAINS
MIETTE RANGE
NIKANASSIN RANGE
CONTINENTAL
QUEEN
CARDINAL RIVER INDIAN RESERVE 234
R 25
R 24
R 23
R 22
R 21
R 20
R 19
R 18

Figure 3


Between Brazeau River and North Saskatchewan River
(North portion)
Pair
Female
Male
Checkpoint
ROCKY
MOUNTAINS
FOREST
FRONT
RANGES
RANGE
BRAZEAU
Saskatchewan River
Tp 44
Tp 43
Tp 42
Tp 41
Tp 40
Tp 39
1:250 000
0 km 6
Produced by
Canadian Wildlife Service
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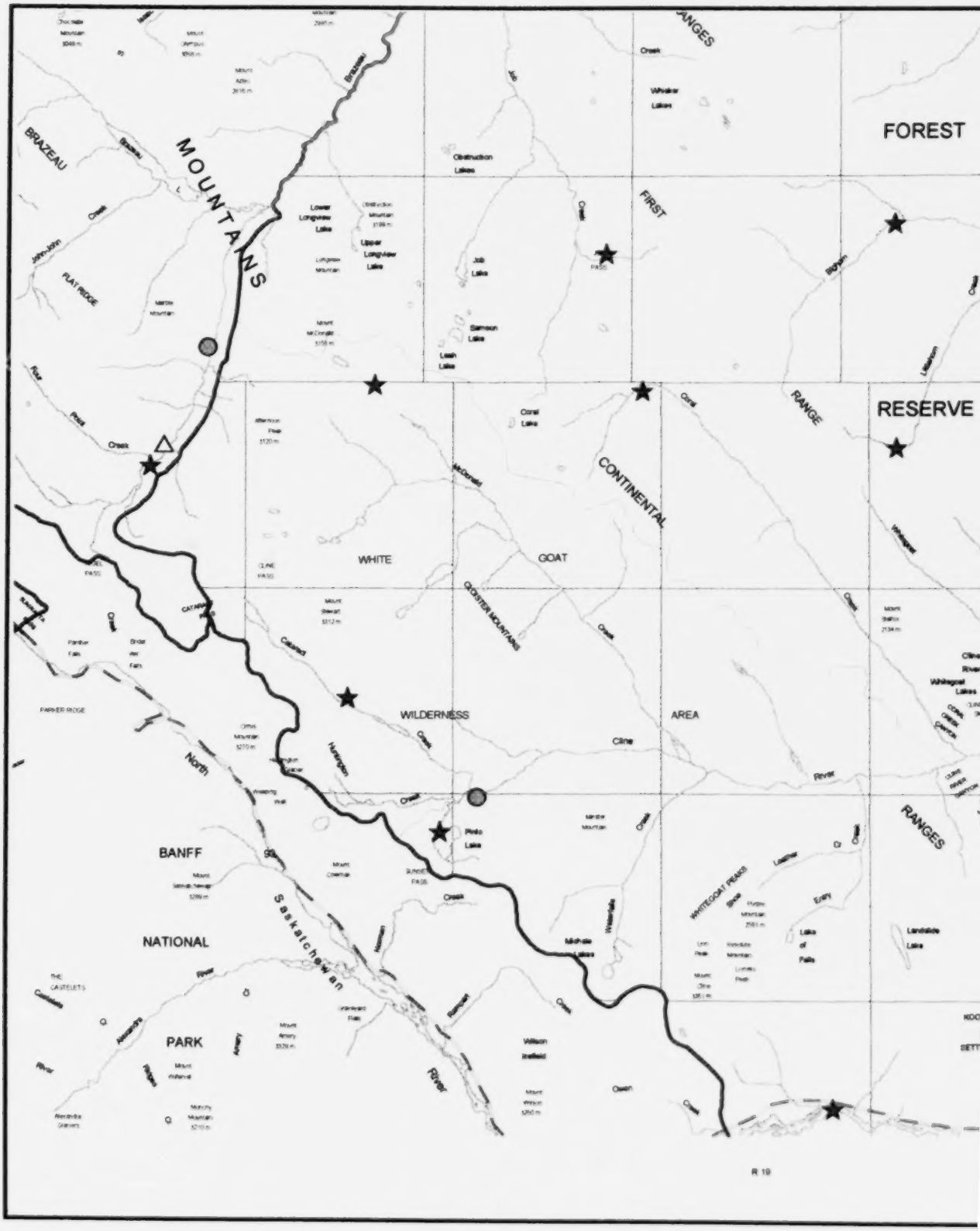
Prairie and Northern Region, 1998

Figure 4


BRAZEAU
MOUNTAINS
FOREST
FIRST
RESERVE
RANGE
CONTINENTAL
WHITE
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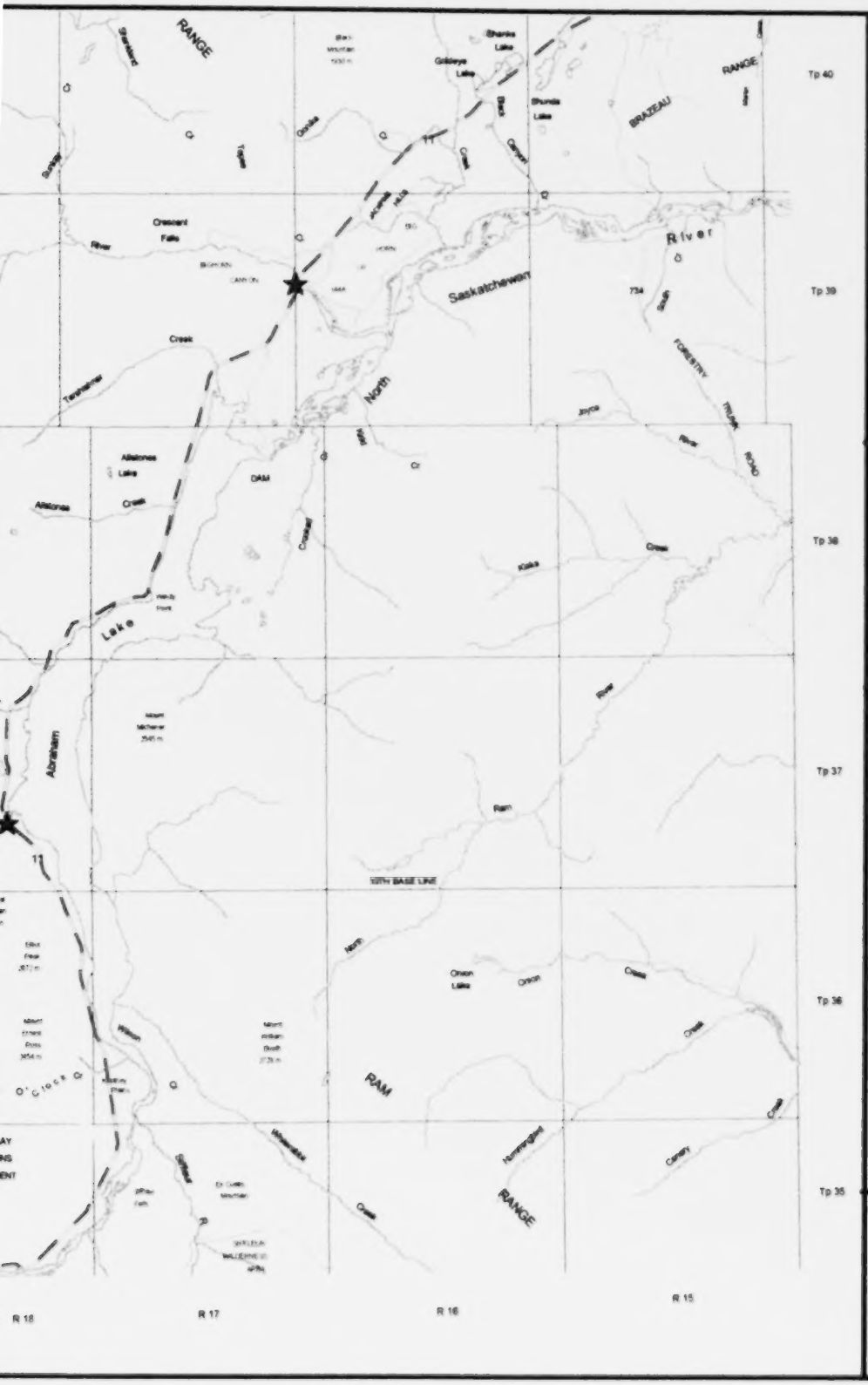
PARKER RIDGE
Creek
R 19

Figure 5



Between Brazeau River and North Saskatchewan River

(South portion)

- △ Pair
- ● Female
- ■ Male
- ★ Checkpoint

N

1:250 000

0 km 6

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